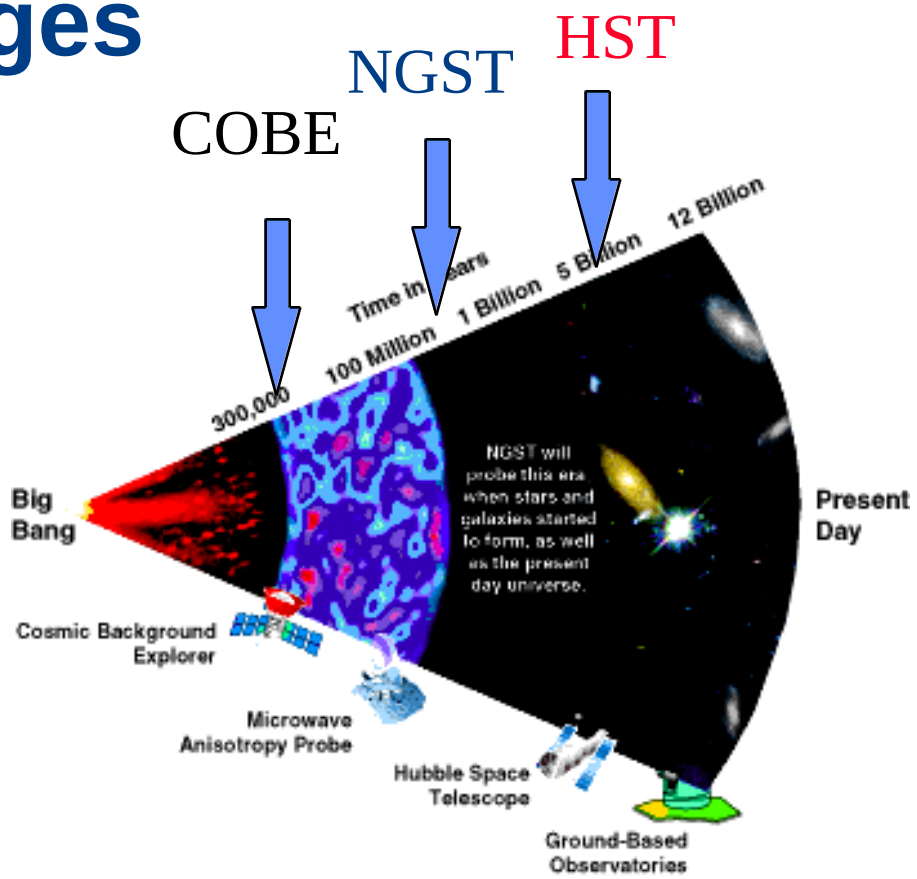
The NGST Scientific Challenges

- **Extend our time horizon to when the first stars were formed**
- Understand the nature of star & planet formation
- Explore the Infrared Universe

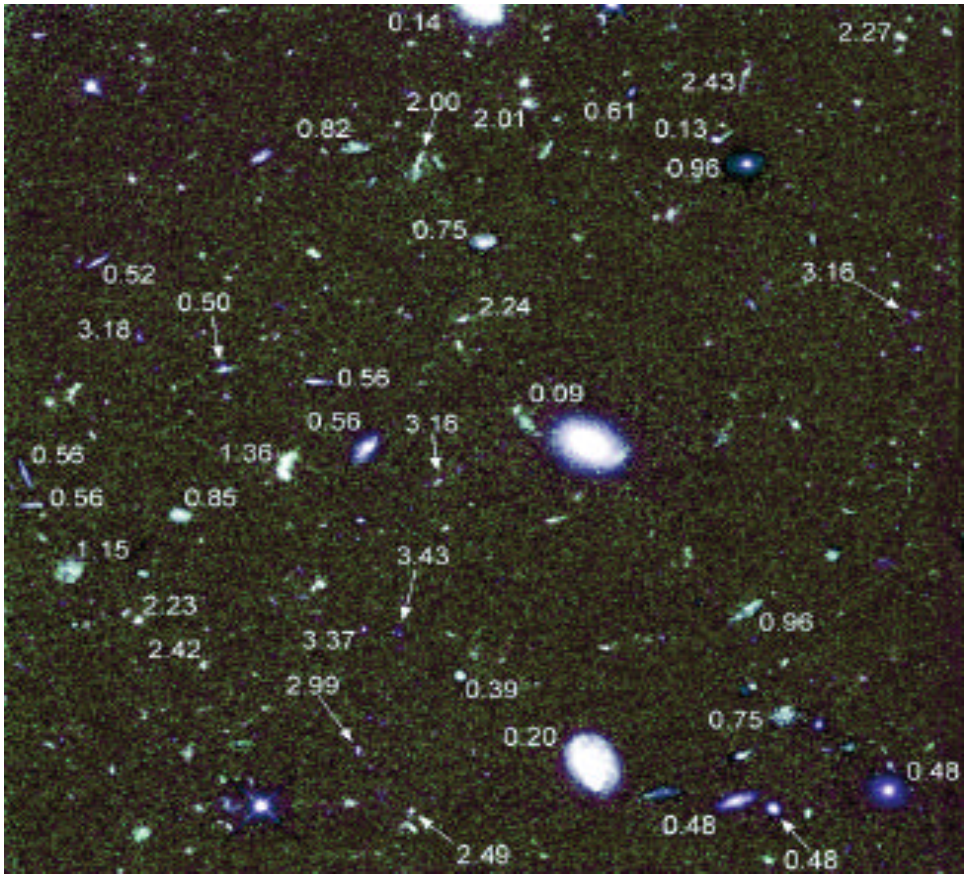
Exploring the Dark Ages

Theory suggests that when the Universe cooled from T ~ 10,000˚ to T ~ 200˚, cooling by molecular hydrogen led rapidly to the first stars and galaxies at z ~ 10-30.



Hubble Deep Field is Our Clearest View of the Past

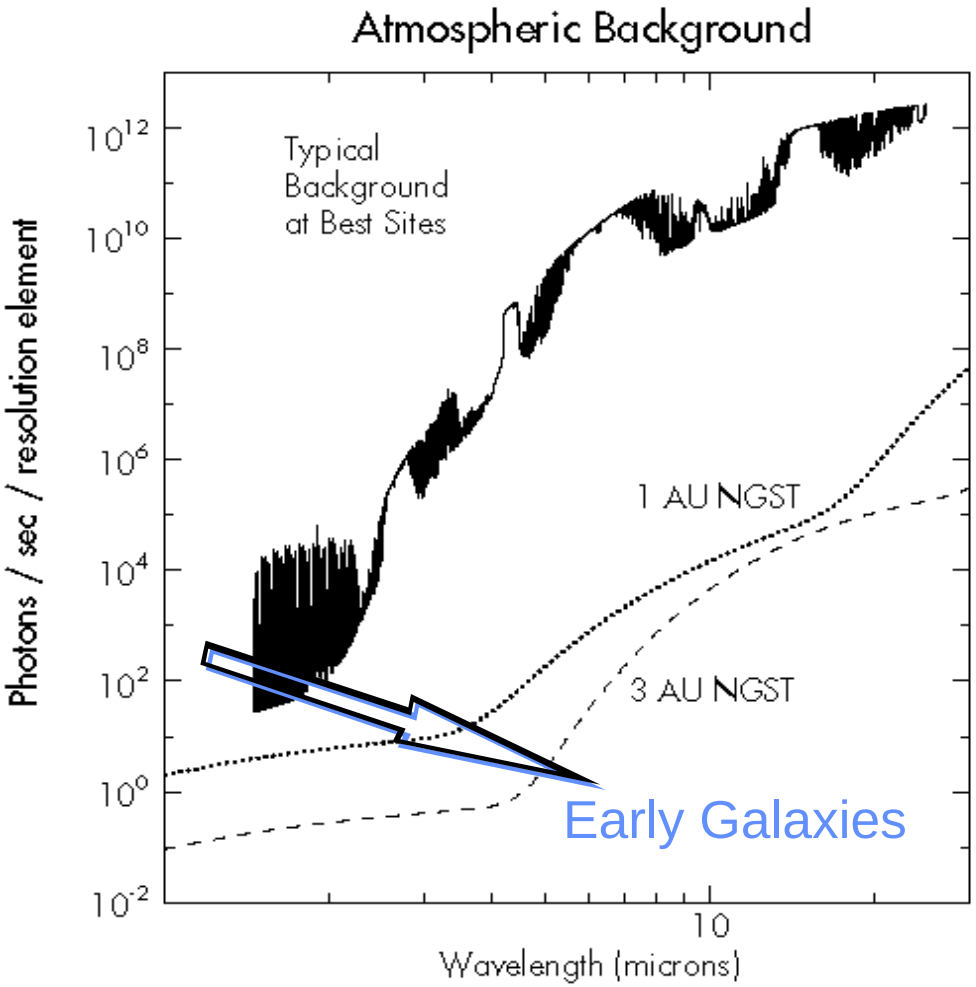
- HST can see galaxies to a redshift of z ~ 3
  - They show small structures
  - Spectra are absorbed by intergalactic hydrogen



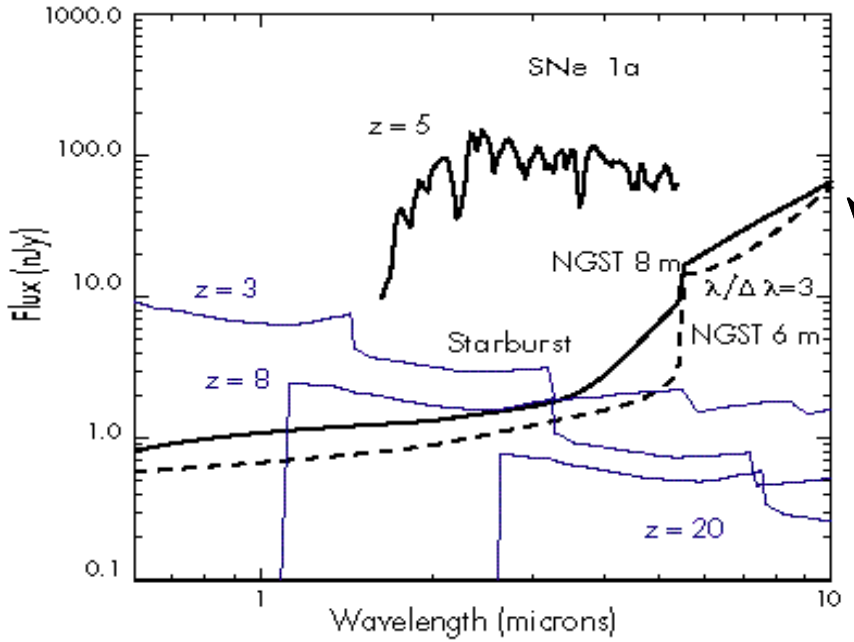
Redshifts by Keck

We Will See the First Starlight in the Infrared

- Passively-cooled space telescopes have much lower backgrounds.
- Early galaxies will be seen beyond 1-3 μm.

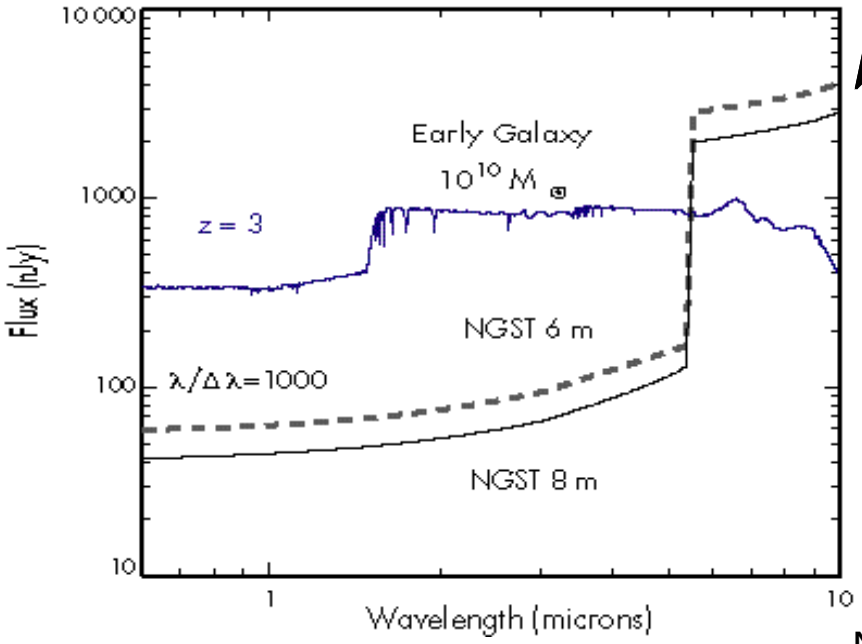


NGST Would See the Earliest Galaxies

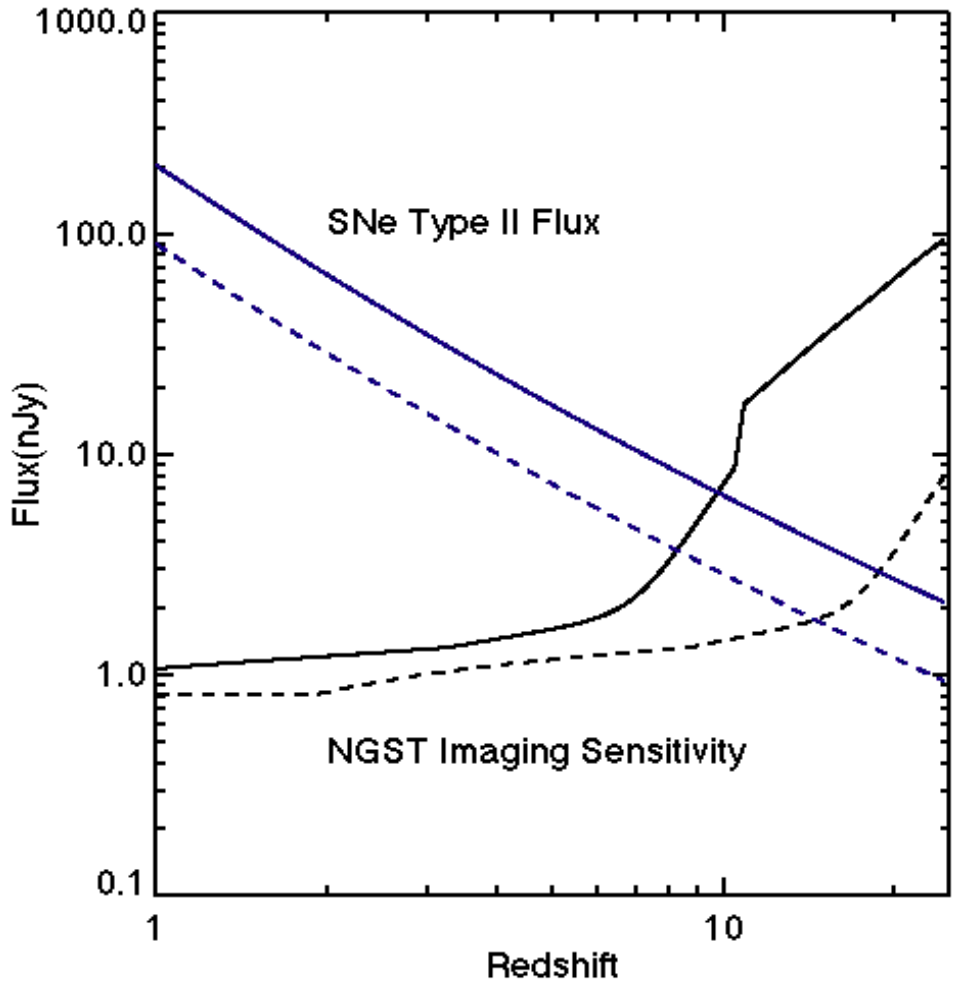


Imaging (Early Starbursts & Supernova)

8-m NGST @L2 &
6-m NGST @ 3AU



Spectra (Early Milky Way)



Supernovae Signal the Beginning of Star Formation and the Creation of Life-essential Elements (C,N,O,etc.)

Our Galaxy Holds the Clues for Star Formation in its Youth and Today

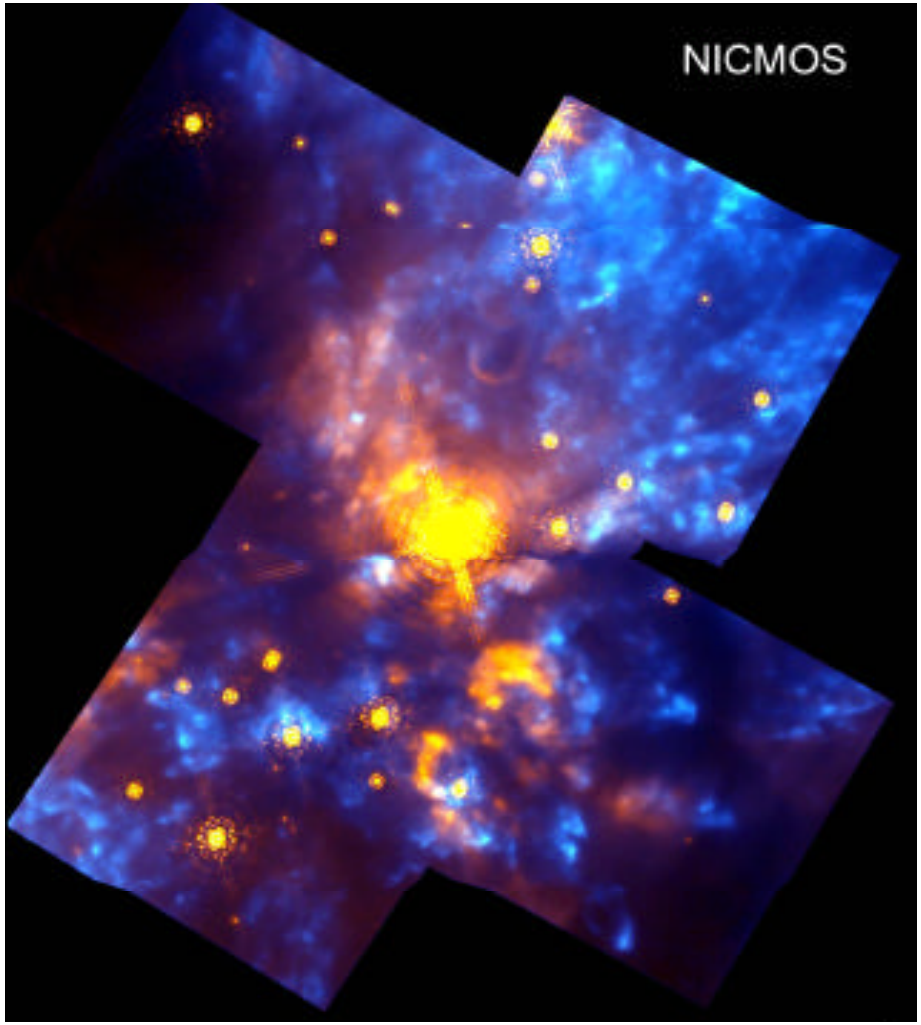
- Fossils of the Earliest Stars may comprise most of the baryonic mass of our Galaxy.

  NGST can detect these stars in our disk & halo.

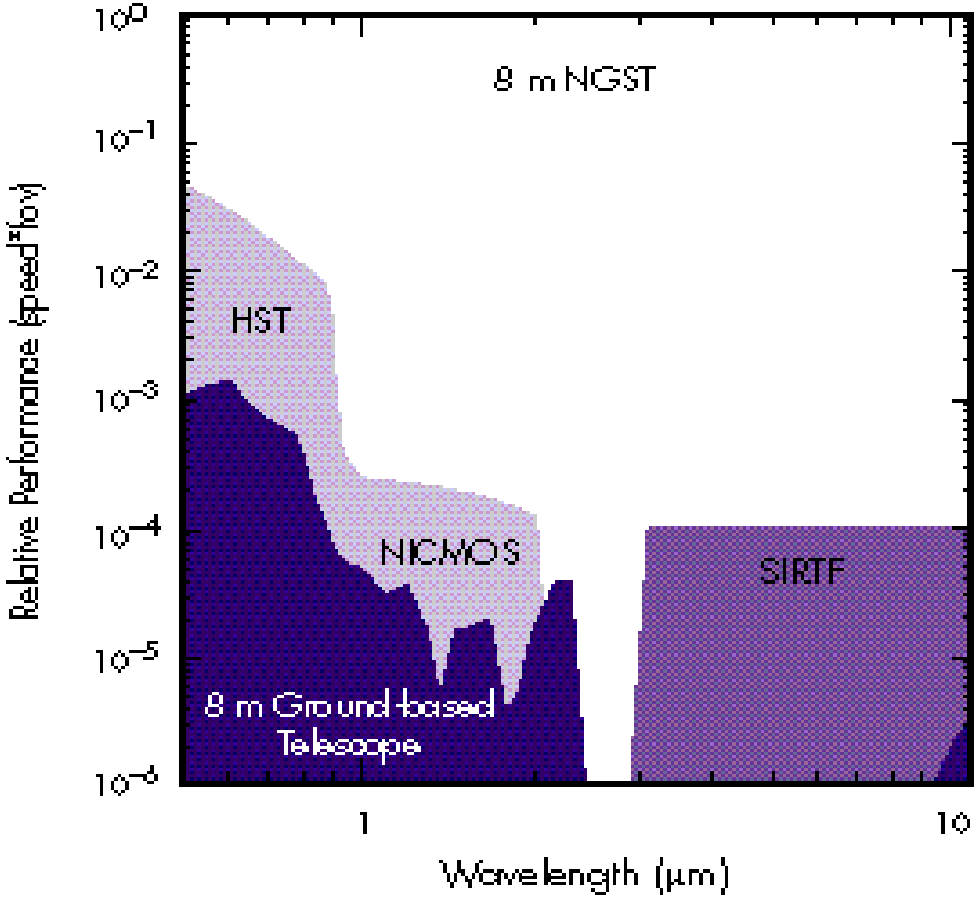
- The Orion stellar nursery offers examples of brief but important protostellar phases: protostellar disks shining beyond 10 μm and warm, possibly free-floating planets.

  NGST can resolve the disks and detect 1 $M_{Jupiter}$ planets.

In the NIR and MIR, NGST Can See Through the Dust that Hides the Centers of Many Galaxies and Star-forming Regions.



NGST will Revolutionize Infrared Astronomy



- Speed 10^2 –10^4 faster than other facilities.
- Improvement is like 1990s compared to the 1950s in visible wavelengths.